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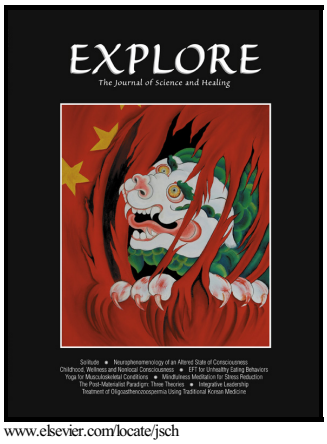

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The Use Osteopathic Manual Therapy and Rehabilitation for Subacromial Impingement Syndrome: A Case Report

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Abstract

Rotator cuff dysfunction is common in athletes involved with overhead sports. Secondary subacromial impingement is a common cause of pain for patients with rotator cuff dysfunction. Exercise rehabilitation and manual therapy can be used in the treatment of subacromial impingement to decrease pain, increase functionality and support a return to activity. The current case report describes a 24-year old patient with supraspinatus tendinosis and secondary subacromial impingement who was experiencing pain when playing tennis, and during daily activities involving overhead movements. Osteopathic manual therapy and rehabilitation was undertaken leading to significant improvements in pain and function over a 6-week period. The current case report describes an evidence-informed approach to the management of subacromial impingement syndrome whilst incorporating a manual therapy technique, balanced ligamentous tension, that has received little attention in the literature.

Key words

rehabilitation; osteopathy; shoulder; outcome measure; osteopathic medicine

Introduction

Pathologies affecting the rotator cuff of the shoulder are common amongst athletes involved in overhead sports (swimming, throwing, tennis), where exposure to repeat micro-trauma causes an accumulation effect leading to pathology [1]. Of the rotator cuff muscle group, the supraspinatus muscle is commonly affected due to its position inferior to the acromioclavicular arch and to the greater tuberosity of the humerus, where there is an area of decreased vascularity. This predisposes the supraspinatus tendon to pathology when coupled with repetitive, high load activities [2]. Tendinosis is a degeneration of the tendon's collagen in response to chronic overuse. When overuse is continued without giving the tendon time to recover, such as with repetitive strain injury, tendinosis results [3]. Supraspinatus tendinosis leads to lack of humeral head control and often subsequent symptoms and signs of subacromial impingement [4]. While rehabilitation exercises and manual therapy have been well documented as being effective in the management of impingement syndrome [5], the use

of Balanced Ligamentous Tension (BLT) has not been published in the treatment of subacromial impingement syndrome (SIS).

Patient information

A 24-year old male (177cm, 77kg, BMI 23) presented to the Victoria University Osteopathy Clinic in August 2015 complaining of right side shoulder pain, inferior to the acromioclavicular joint and a feeling of instability in the glenohumeral (GH) joint. The patient was working as a tennis coach and personal trainer, in addition to playing tennis once a week in a semi-competitive competition. The presenting episode of shoulder pain had commenced six weeks prior. The patient noted pain particularly with over-head strokes such as serving, and rated this as a 6 out of 10 pain on a visual analogue scale (VAS). The patient noted that the pain was equivalent to the worst it had been since the onset seven years prior.

The patient reported a history of right shoulder issues. The initial shoulder injury seven years ago occurred when the patient was tackled in a game of Australian Rules football and landed heavily onto the acromion of the right shoulder. Magnetic resonance imaging (MRI) two months after the initial injury revealed tendonitis of the supraspinatus tendon, and a decrease in the sub-acromial space on the right. Since the initial shoulder trauma, the patient had undergone periods of exacerbations and remissions attending both physiotherapists and osteopaths intermittently for treatment. The remissions were closely related to periods of treatment, rehabilitation and rest. The patient noted improvements in function and range of motion as well as a decrease in pain at the initial treatment, as well as after receiving subsequent treatments. However, these improvements were not sustained. The exacerbations would follow when the patient perceived the complaint resolved, only to return to activity, reinjure the right shoulder. It had been 6 months since the patient last sought treatment for the complaint prior to presenting to the clinic. The patient gave specific signed consent for the preparation of this case report.

Diagnostic assessment

A musculoskeletal examination was conducted on the patient. Internal rotation of the humerus on the right side and winging of the medial border with protraction of the right scapula was observed during a static postural

assessment. Palpation revealed hypertonicity and tenderness of the right rotator cuff - supraspinatus, subscapularis, teres major and infraspinatus muscles. Hypertonicity was also noted on palpation of the pectoralis minor and major on the right side, as well as the right upper trapezius. Change in muscle tone of the upper trapezius has been observed in scapular dyskinesis associated with SIS [6] and in overhead athletes with rotator cuff tendinopathy [7]. Lopes et al. [6] notes that the scapular dyskinesis may be the cause of, or the result of compensatory changes in SIS. Reproduction of the presenting pain (familiar pain) was noted at 120° through 180° of active shoulder abduction, and at 150° to 180° of passive shoulder abduction. Familiar pain was also reported at 20° of internal rotation at 90° of shoulder abduction on the right side. ROM measurements were based on observation and not by a more objective measure (i.e. goniometer). A restricted range of active motion was noted at T1-4 for rotation and side-bending to the left. Strength testing demonstrated an asymmetry with right internal rotation, external rotation and shoulder abduction (grade 4) compared to grade 5 on the left side. Orthopaedic testing is described in Table 1.

Table 1. Orthopaedic testing of the shoulder complex at the initial presentation [8].

Test	Result
Hawkins-Kennedy test	Positive
Neer's impingement test	Positive
Empty can test	Positive
Lift off test	Positive
Acromioclavicular joint crossover test	Negative
Speeds test	Negative
O'Brien's test	Negative
Load and shift test	Negative
Apprehension test	Negative

Note: all tests were negative on the left side. A positive result is defined as pain provocation or positive as defined by the relevant test.

The orthopaedic testing ensured that both sensitive and specific tests for subacromial impingement syndrome (SIS) were included [9]. A combination of the positive Hawkins-Kennedy, Neer's and empty can tests, along with a reduction in GH external rotation strength [10], and the clinical history [11] supported a provisional diagnosis of subacromial impingement syndrome (SIS) (ICD-10 - 75.4). Further imaging (MRI) was deemed unnecessary with the history and examination and a treatment plan was proposed.

Two patient-report outcome measures were utilised to monitor progress: the QuickDASH (Disabilities of the Arm, Shoulder, & Hand) [12-14] and the Upper Extremity Functional Index (UEFI) [15, 16]. The UEFI was chosen as it has a high degree of sensitivity to change in score with changes in the presenting complaint [17].

The initial QuickDASH score was 34.09 suggesting a moderate level of shoulder disability. The initial UEFI score was 66 out of a possible 80, with lower scores being indicative of greater disability. Items from the UEFI outcome that scored high, or the patient noted as 'quite a bit difficult' included; *throwing a ball*, and *lifting a bag of groceries above your head*.

Therapeutic intervention

At the initial appointment and in subsequent appointments, osteopathic manual therapy (OMTh) was applied to the dysfunctional areas. The OMTh included cross fibre massage and direct myofascial release applied to pectoralis major and minor [18], muscle energy technique to the upper trapezius muscle. High velocity low amplitude technique (HVLA) was used to achieve cavitation at T2/3 and T3/4 and improve the range of motion in the upper thoracic spine. Inhibition (steady pressure) was applied the supraspinatus, subscapularis and teres major muscles to reduce the hypertonicity [18]. Balanced ligamentous tension technique [19] was applied to the glenohumeral joint. The patient was advised to avoid activities that aggravated the shoulder complaint or activities that put a load through the shoulder while in a position above 90° of abduction.

The patient was prescribed an exercise rehabilitation program (Table 2). The intention of the rehabilitation program was to strengthen the rotator cuff muscles, while stretching the pectoralis muscles to improve positioning of the humeral head in the glenoid fossa [18], and decrease internal rotation of the humerus. Strengthening of rhomboids, lower trapezius and serratus anterior was undertaken to improve scapula control.

Table 2. Exercise rehabilitation program to assist in the management of subacromial impingement syndrome in the current patient.

Exercise	Notes	Sets	Repetitions	Weeks undertaken
Shoulder internal rotation	Shoulder at neutral	2	20	1-6
Shoulder external rotation	Shoulder at neutral	2	20	1-6
Shoulder abduction	Open-can position. Up to 90° of abduction.	2	20	1-6
Pectoralis stretch	Hold for 30 seconds	3		1-6
Scapula push-ups	Initially with hands placed on a bench to ensure that the patient is not horizontal in order to reduce the difficulty	3	10	3-6
Single arm row	Shoulder at neutral	3	10	3-6
Lower trapezius activation	Draw scapulae 'down and back'. Hold for 5 seconds	2	10	3-4
Lower trapezius stability	Standing against a wall, abducting both arms to full 180° while keeping hands in contact to the wall and ensuring upper traps do not activate.	3	10	4-6

Follow up and outcomes

OMTh was continued weekly for six weeks, with a continued focus on reducing the hypertonicity of the anterior chest muscles and the rotator cuff muscles, while rehabilitation progressed as pain symptoms decreased and rotator cuff strength increased. Theraband® was used to progress the exercises with increasing resistance starting with a *red* Theraband® for two weeks, progressing at two week intervals to *green* and then *blue* Theraband®. The patient chose to play tennis in the initial two-week treatment period subsequently aggravating the complaint. Following this, that patient elected to discontinue playing tennis for the remainder of the time the patient attended the clinic. Patient-reported compliance with the exercise rehabilitation program was good, often completing the prescribed program for five to seven days of the week.

On review six weeks post-initial consultation, the patient reported minor discomfort over the supraspinatus tendon at end range shoulder abduction (both active and passive movements). The Hawkins-Kennedy and Neer's impingement tests were negative, and the empty can test yielded minor discomfort. Strength testing revealed symmetrical results for both shoulders (full strength – grade 5). Range of motion for internal rotation at 90° of shoulder abduction was now symmetrical bilaterally (approximately 50°). At this six-week review the patient was yet to return to playing tennis, but was expected to return to sport in the next two weeks. At a five

month follow up (April 2016) the patient reported being 99% pain free, returned to playing tennis once a week, and also coaching at the same level as prior to the current presentation. The patient did however note some minor weakness with overhead serves.

The Quick-DASH and UEFI [15] were re-administered at six weeks. There was a significant improvement for the UEFI over the minimum level of detectible change score of nine points, from 66/80 to 77/80, with improvements in activities such as *throwing a ball*, *lifting a bag of groceries above your head* and usual work activities proving to be only 'a little bit difficult', all other activities provided no difficulty. Similarly, the Quick-DASH showed marked improvement in the score from 34.09 down to 6.82, indicating an improvement in shoulder function and 'substantial clinical benefit' of greater than 40% over a six-week period as suggested by Michener et al. [20]. The patient now rated his pain at worse pain as a 1 out of 10 on the VAS when undertaking end range shoulder abduction.

Discussion

Current research suggests that a comprehensive rehabilitation program coupled with manual therapy can be effective in the management of secondary shoulder impingement syndrome. Manual therapy techniques combined with therapeutic exercise, particularly upper quarter joint articulation [21], appear to provide better outcomes than therapeutic exercise alone [5]. This is especially the case when it is evident that poor scapulothoracic stabilization and weakness in the rotator cuff muscles is prevalent [22]. Abnormal positioning of the scapula as a result of weakness of the scapulothoracic muscles can lead to a reduction in the subacromial space [18, 23]. Likewise weakness in the rotator cuff can result in abnormal translation of the humeral head, further narrowing the subacromial space and subsequent encroachment of the contents including the supraspinatus and subacromial bursa [24]. Repetition of this trauma, especially at high velocity and high load while performing an overhead movement (i.e. throwing, playing tennis), can lead to degeneration of the supraspinatus tendon and subsequent development of tendinosis [2].

Rehabilitation exercises focusing on scapula control via increasing the strength and endurance of the scapulothoracic muscles, especially serratus anterior, lower trapezius and rhomboids should be undertaken [25]. Stretching of the anterior chest muscles, pectoralis major and minor, is also important to be applied in

conjunction with strengthening of the scapula stabilizers. Lengthening of the anterior chest muscles aims to decrease any winging or tilting of the scapula and decrease internal rotation of the humerus, which will serve to increase the subacromial space. Regaining strength of the rotator cuff muscles is imperative to regain stabilization of the GH joint. Internal and external rotation exercises serve to target the subscapularis muscle and the infraspinatus and teres minor muscles respectively [26]. Exercises should be performed with the GH joint in neutral, not at 90° of abduction, in order to avoid exacerbation of a supraspinatus tendinosis. Supraspinatus can be strengthened using the same position as the open can test. Jobe and Moynes [26] proposed that the empty can position may be used, however more recently it is noted that while both positions are effective in the activation of supraspinatus, the open can position is more suitable in that it avoids further aggravation of the tendinosis [27].

Bang and Deyle [28] indicated that manual therapy including soft tissue and mobilization, coupled with a home exercise program was effective in reducing pain and increasing functionality of patients with shoulder impingement syndrome. Kamkar et al. [29] agreed and suggests increasing range of motion of the shoulder via stretching techniques. Kachingwe et al. [30] demonstrated that GH joint mobilisation could reduce pain in patients with shoulder impingement, but suggested this be used in conjunction with soft tissue techniques and exercise rehabilitation.

There is no research that has utilised Balanced Ligamentous Tension (BLT) in the treatment of SIS, and very little literature on this manual therapy technique. When performing a BLT technique, the practitioner aims to position the patient's dysfunctional area in a point of ease [19]. This allows for a release in the dysfunctional tissue and potentially a tissue texture change to occur. Zein-Hammoud and Standley [31] suggest that changing tension in injured tissues has a beneficial impact on the fibroblast. The fibroblast has an important role in healing in tendon injuries. It may be that reducing tensions in the connective tissues with OMTh may promote normal function of the fibroblast, healing and reduction in the patient's symptoms. In the case of the GH joint, the target tissue is the joint capsule. By balancing the tension of the joint capsule, it is posited a release of the posterior joint capsule may be achieved. Kamkar et al. [29] note that tightness of the GH joint capsule, particularly the posterior capsule, may lead to superior migration of the humeral head, predisposing impingement of the subacromial space. Posterior capsule tightness has been shown to result in loss of internal rotation in patients with impingement syndromes [32]. The use of a BLT technique may be indicated with the

occurrence of posterior GH capsule tightness as it mimics a strain in the balanced ligamentous articular mechanism, where an alteration in the normal joint range of motion has occurred [33]. Manual therapy interventions for SIS describe techniques [28, 30] that are aimed at directly at the restrictive barrier (soft tissue stretching, direct myofascial release, joint stretching and HVLA), the use of indirect techniques such as BLT may provide an additional approach to support a patient-centred approach [34, 35] to therapy. Indirect techniques are gentle with little potential aggravation of the patient's symptoms providing an approach to support choice in applying non-painful techniques that may also provide benefit.

While the evidence for the use of manual therapy and rehabilitation exercises in the treatment of subacromial impingement syndrome is well documented, this is the first case report to describe an osteopathic approach to its management. Further, this is one of the few descriptions of the use of BLT in the manual therapy literature. The current case report suggests that BLT may have a role in supporting a patient-centred approach to the management of SIS. Further research is required to determine the efficacy of BLT and its impact on ROM and pain in shoulder complaints; however its use in conjunction with other osteopathy and exercise rehabilitation approaches may be indicated in the case of SIS.

Informed consent

A signed consent form from the patient allowing the publication of this case report is available from the authors. No Institutional human research ethics application was applied for.

References

[1] Wilk KE, Arrigo C. Current concepts in the rehabilitation of the athletic shoulder. J Orthop Sports Phys Ther. 1993;18:365-78.

[2] Hawkins R, Kennedy J. Impingement syndrome in athletes. Am J Sports Med. 1980;8:151-8.

[3] Bass E. Tendinopathy: why the difference between tendinitis and tendinosis matters. Int J Ther Massage Bodywork. 2011;5:14-7.

[4] Brukner P, Khan KM. Clinical Sports Medicine. 4th ed. Sydney, Australia: McGraw Hill; 2012.

[5] Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. J Hand Ther. 2004;17:152-64.

[6] Lopes AD, Timmons MK, Grover M, Ciconelli RM, Michener LA. Visual scapular dyskinesis: kinematics and muscle activity alterations in patients with subacromial impingement syndrome. Arch Phys Med Rehabil. 2015;96:298-306.

[7] Leong HT, Hug F, Fu SN. Increased Upper Trapezius Muscle Stiffness in Overhead Athletes with Rotator Cuff Tendinopathy. PLoS One. 2016;11. doi: 10.1371/journal.pone.0155187.

[8] Magee DJ. Orthopedic Physical Assessment: Elsevier Health Sciences; 2014.

[9] Calıs M, Akgün K, Birtane M, Karacan I, Calıs H, Tüzün F. Diagnostic values of clinical diagnostic tests in subacromial impingement syndrome. Ann Rheum Dis. 2000;59:44-7.

[10] Michener LA, Walsworth MK, Doukas WC, Murphy KP. Reliability and diagnostic accuracy of 5 physical examination tests and combination of tests for subacromial impingement. Arch Phys Med Rehabil. 2009;90:1898-903.

[11] Hegedus EJ, Goode AP, Cook CE, Michener L, Myer CA, Myer DM, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests. Br J Sports Med. 2012. doi: 10.1136/bjsports-2012-091066.

[12] Beaton DE, Wright JG, Katz JN. Development of the QuickDASH: comparison of three item-reduction approaches. J Bone Joint Surg. 2005;87:1038-46.

[13] Gummesson C, Ward MM, Atroshi I. The shortened disabilities of the arm, shoulder and hand questionnaire (QuickDASH): validity and reliability based on responses within the full-length DASH. BMC Musculoskelet Disord. 2006;7:44.

[14] Hudak PL, Amadio PC, Bombardier C, Beaton D, Cole D, Davis A, et al. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder, and hand). Am J Ind Med. 1996;29:602-8.

[15] Chesworth BM, Hamilton CB, Walton DM, Benoit M, Blake TA, Bredy H, et al. Reliability and validity of two versions of the upper extremity functional index. Physiother Can. 2014;66:243-53.

[16] Stratford PW, Binkley JM, Stratford DM. Development and initial validation of the upper extremity functional index. Physiother Can. 2001;53:259-67.

[17] Razmjou H, Bean A, van Osnabrugge V, MacDermid JC, Holtby R. Cross-sectional and longitudinal construct validity of two rotator cuff disease-specific outcome measures. BMC Musculoskelet Disord. 2006;7:1.

[18] Houglum PA. Rehabilitation for Subacromial Impingement Starts at the Scapula. J Orthop Trauma Rehabil. 2013;17:54-60.

[19] Nicholas AS, Nicholas EA. Atlas of osteopathic techniques: Lippincott Williams & Wilkins; 2008.

[20] Michener LA, Valier ARS, McClure PW. Defining substantial clinical benefit for patient-rated outcome tools for shoulder impingement syndrome. Arch Phys Med Rehabil. 2013;94:725-30.

[21] Knebl JA, Shores JH, Gamber RG, Gray WT, Herron KM. Improving functional ability in the elderly via the Spencer technique, an osteopathic manipulative treatment: A randomized, controlled trial. J Am Osteopath Assoc. 2002;102:387-96.

[22] Escamilla RF, Hooks TR, Wilk KE. Optimal management of shoulder impingement syndrome. Open Access Journal of Sports Medicine. 2013;5:13-24.

[23] Leong HT, Tsui SSM, Ng GY-f, Fu SN. Reduction of the subacromial space in athletes with and without rotator cuff tendinopathy and its association with the strength of scapular muscles. J Sci Med Sport. 2016.

[24] Neumann DA. Kinesiology of the musculoskeletal system: foundations for rehabilitation: Elsevier Health Sciences; 2013.

[25] Ludewig P, Borstad J. Effects of a home exercise programme on shoulder pain and functional status in construction workers. Occup Environ Med. 2003;60:841-9.

[26] Jobe FW, Moynes DR. Delineation of diagnostic criteria and a rehabilitation program for rotator cuff injuries. Am J Sports Med. 1982;10:336-9.

[27] Dun S, Barrentine SW, Ellerbusch MT, Andrews JR. Electromyographic analysis of the supraspinatus and deltoid muscles during 3 common rehabilitation exercises. J Athle Train. 2007;42:464.

[28] Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. J Orthop Sports Phys Ther. 2000;30:126-37.

[29] Kamkar A, Irrgang JJ, Whitney SL. Nonoperative management of secondary shoulder impingement syndrome. J Orthop Sports Phys Ther. 1993;17:212-24.

[30] Kachingwe AF, Phillips B, Sletten E, Plunkett SW. Comparison of manual therapy techniques with therapeutic exercise in the treatment of shoulder impingement: a randomized controlled pilot clinical trial. J Man Manip Ther. 2008;16:238-47.

[31] Zein-Hammoud M, Standley PR. Modeled Osteopathic Manipulative Treatments: A Review of Their in Vitro Effects on Fibroblast Tissue Preparations. J Am Osteopath Assoc. 2015;115:490-502. doi: 10.7556/jaoa.2015.103.

[32] Conroy DE, Hayes KW. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. J Orthop Sports Phys Ther. 1998;28:3-14.

[33] Chila AG. Foundations of Osteopathic Medicine. Lippincott Williams & Wilkins; 2010.

[34] Mead N, Bower P. Patient-centred consultations and outcomes in primary care: a review of the literature. Patient Educ Couns. 2002;48:51-61.

[35] Orrock PJ. The patient experience of osteopathic healthcare. Man Thera. 2015;22:131-7. doi: 10.1016/j.math.2015.11.003.